

Hybrid Electric Vehicle Program— building a low emissions vehicle for widespread use in the short term

Electric vehicles produce no emissions but, with current technologies, provide limited range and performance. Internal combustion vehicles, such as today's automobiles, provide satisfactory range and performance, but produce significant emissions.

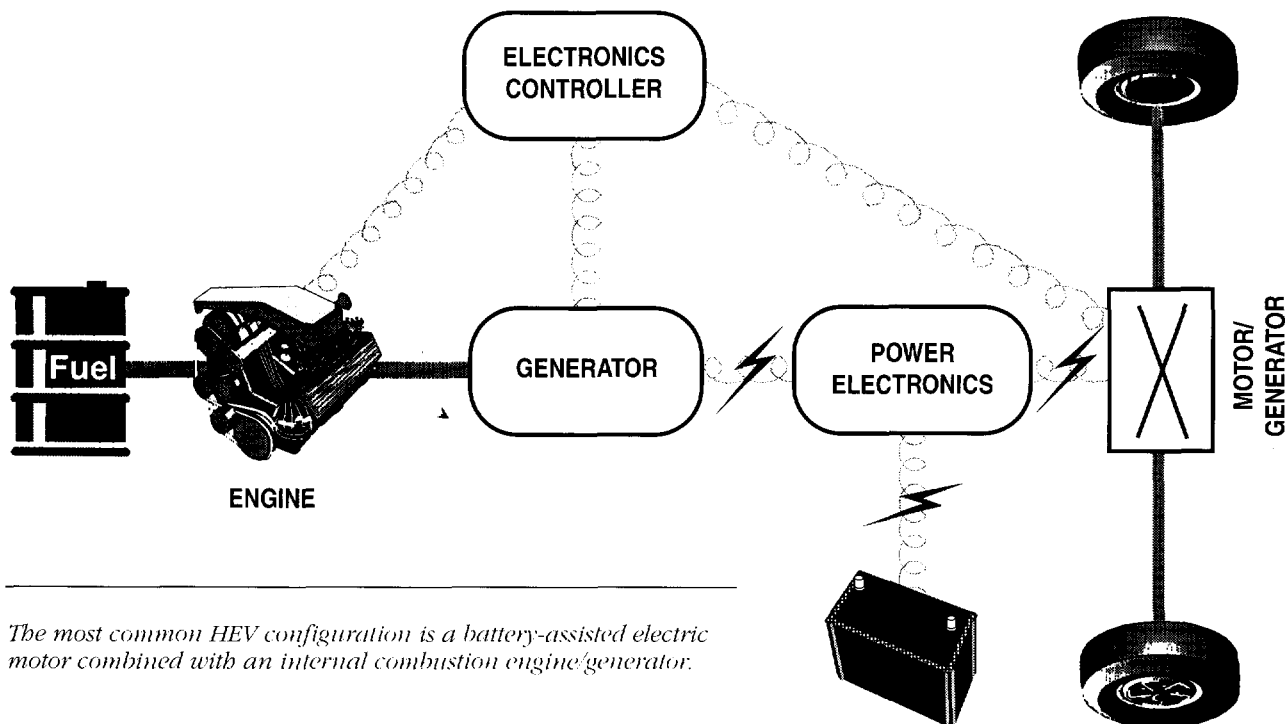
In one of the newest programs sponsored by the U.S. Department of Energy (DOE), competitive industry teams are working to produce a vehicle that combines the best features of both technologies—and make it available for the mass market perhaps as early as the next decade. The success of the Hybrid Electric Vehicle Program would help improve the environmental performance of the automobile, reduce American dependence on foreign oil, and help reshape the international auto industry.

Hybrids—the best of both worlds

As their name suggests, hybrid electric vehicles

(HEVs) use more than one method to convert stored energy to propulsion energy. The most common configuration is a battery-assisted electric motor combined with an internal combustion engine/generator operating on traditional gasoline or alternative fuel such as ethanol.

At face value, HEVs produce fewer emissions than conventional vehicles because they burn less fuel to go the same distance. However, a combination of the two systems offer engineers additional opportunities to build-in energy-saving innovations. For example, HEVs can store excess electrical energy during coasting, idling and other periods of low power demand, which can then be drawn upon during periods of high power demand. HEVs also recover the energy that would normally be lost when braking a conventional vehicle and store it for later use. For these reasons, an HEV internal combustion engine can be smaller than the engine



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in a comparable conventional vehicle, improving fuel efficiency and environmental performance when in the non-electric mode. When the internal combustion engine is operated using non-petroleum fuel, emissions are reduced even further.

Acceptable to consumers

The basic technologies that make HEVs possible already exist, many of them developed in DOE laboratories over the past 20 years. In addition, it is understood that HEVs have an inherent "head start" over other forms of alternative transportation because they can offer the range and performance consumers are accustomed to, are similar in appearance to conventional automobiles, make use of existing infrastructure (gas stations), are easy to re-fuel, and provide competitive life-cycle costs. For these reasons, there are fewer practical barriers that could hinder short-term production and market acceptance of HEVs.

DOE-sponsored teams building a prototype for mass-production models

DOE announced a request for proposals in late 1992, inviting industry teams to submit a plan for developing an HEV prototype that would meet several goals. Among them, that the prototype would be at least twice as fuel efficient as current production models, that it would meet the Environmental Protection Agency's Federal Tier II emissions standards (equivalent to California Ultra-Low Emissions

requirements), and that overall costs, safety standards and range and performance levels would be competitive with current vehicles.

Out of seven proposals submitted, two were chosen—those of teams led by General Motors Inc. and Ford Motor Company. The General Motors agreement, with government/industry cost-shared funding of \$138 million, includes 11 team members. The Ford contract, cost-shared at \$122 million, includes 17 subcontractors.

Towards the end of a five-year development and testing period, each team will present a state-of-the-art prototype hybrid electric vehicle. It is hoped that these designs will achieve the levels of cost-effectiveness and consumer acceptance that would lead directly to production vehicles by the 2001 model year. Federal orders for the vehicles could begin as early as the 1998 fiscal year, helping to get the vehicles on the road and familiar to American consumers. The possibility of DOE involvement in longer-term HEV research programs will be determined at a later date.

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